

# *Horizontal/Vertical Integration*

*GEC5 Substrate Working Group*

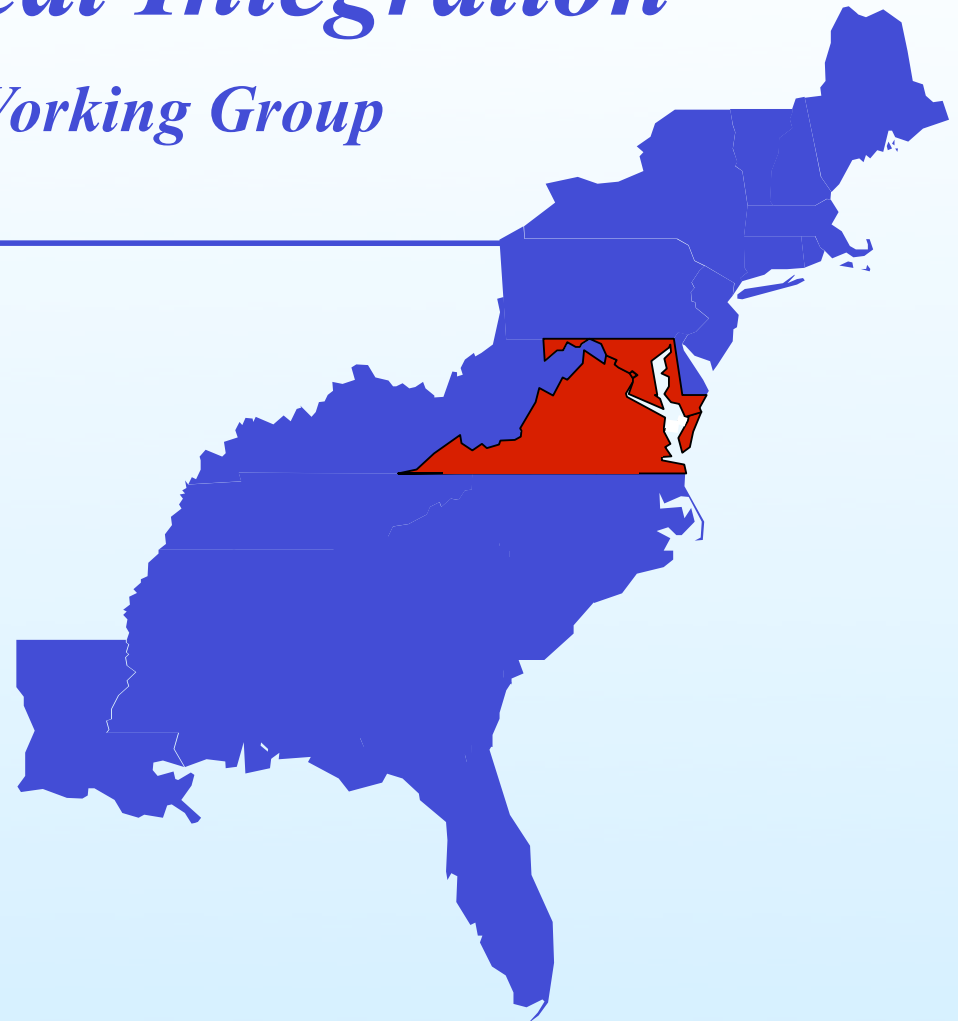
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Cluster B Participant

July 21st, 2009

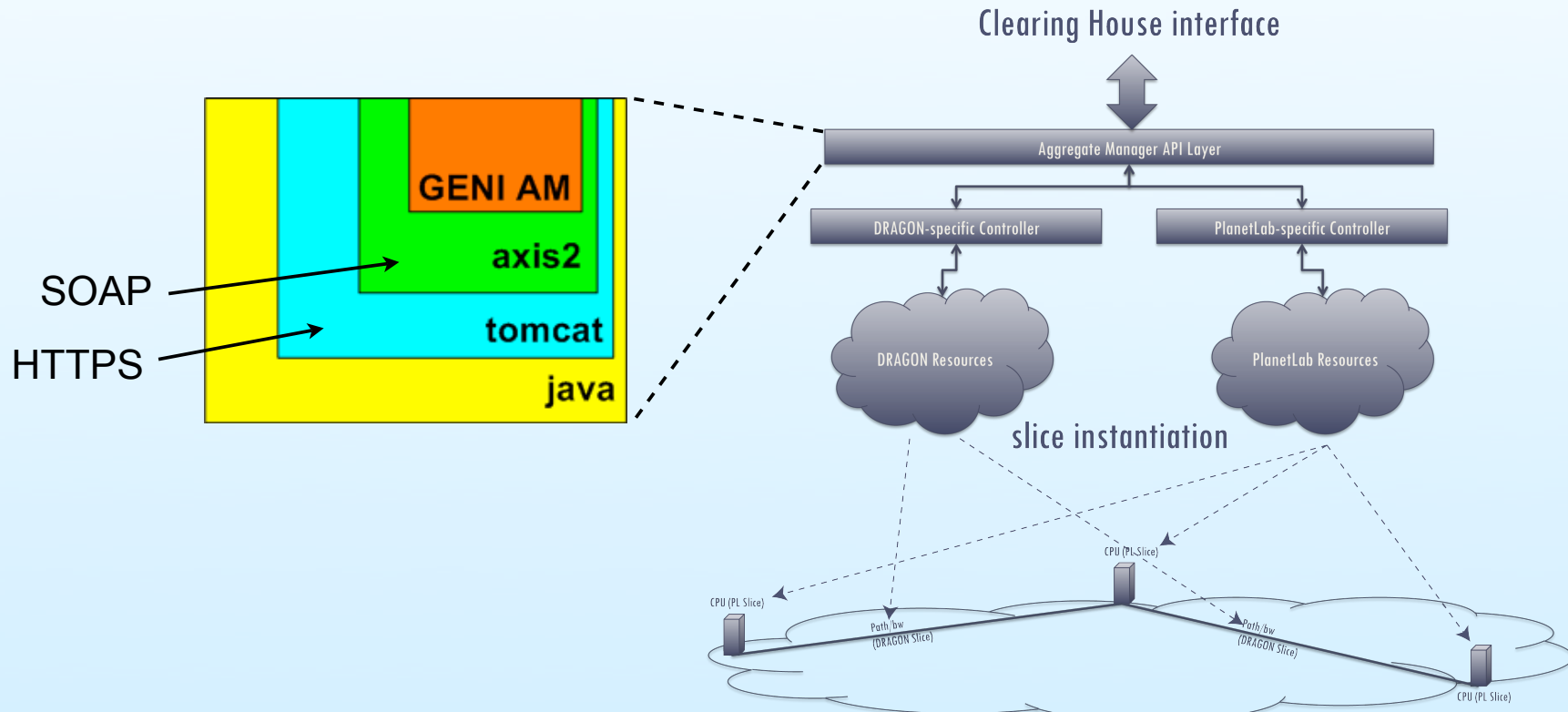


## *Outline*

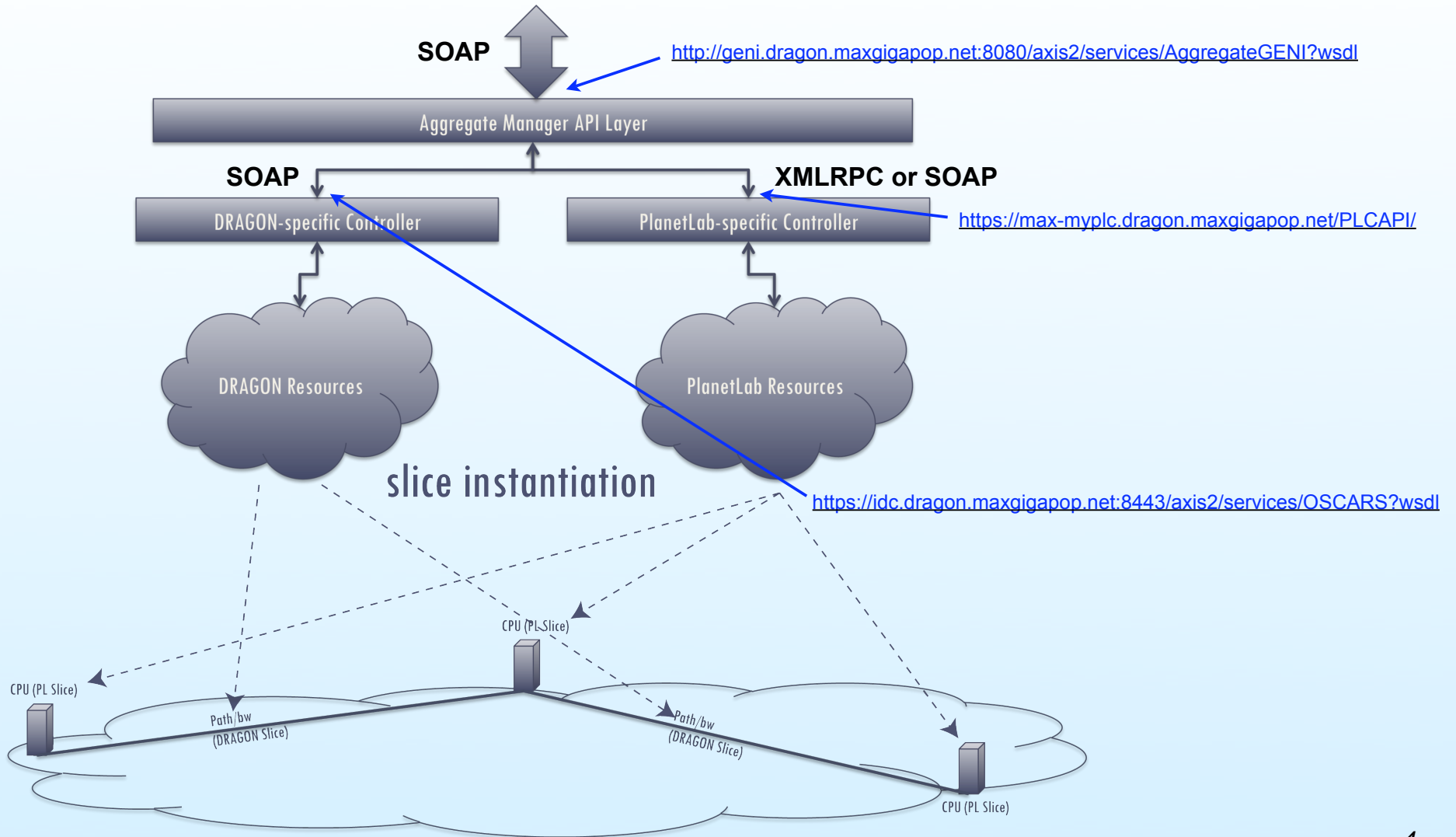
- Architecture
  - SOAP-based Aggregate Manager
  - Resource-specific Controllers
- Vertical Integration
- Horizontal Integration

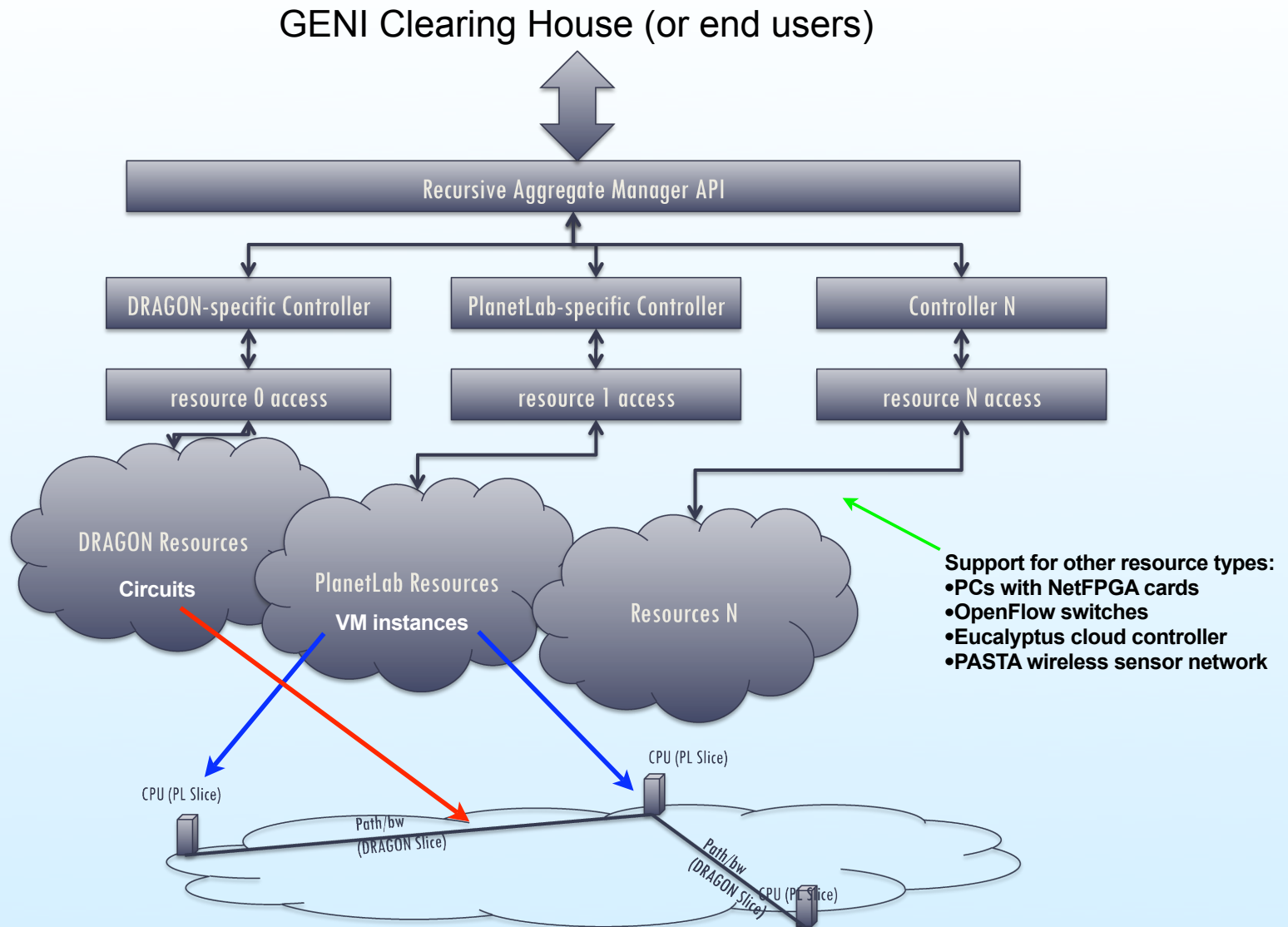
## *SOAP-based GENI Aggregate Manager*

- Java-based reference implementation
- Provides Web Services API (WSDL) to clients
- Deployed in Apache Tomcat as an Axis2 service



## Clearing House interface





## Example using a generic SOAP client

location of top-level Recursive AM API

method functions exported by WSDL

response from ListCapabilities function

aggregate supports DRAGON  
...via this URL

aggregate supports PlanetLab  
...via this URL

The screenshot shows a SOAP client window titled "Untitled". At the top, the WSDL URL is set to `http://geni.dragon.maxgigapop.net:8080/axis2/services/AggregateGENI?wsdl`. Below this, the "Service" is identified as "AggregateGENI". A dropdown menu is open, listing methods: ListCapabilities (checked), ListNodes, CreateSlice, DeleteSlice, UpdateSlice, StartSlice, StopSlice, ResetSlice, and QuerySlice. The "EndpointURL" is `http://maxgigapop.net:8080/axis2/services/AggregateGENI/` and the "Namespace" is `http://geni.net/services/api/`. The "Parameters" field contains `filter: "`. At the bottom, the "Pretty Response" tab is selected, showing the following XML:

```

<ns1:capability>
  <ns1:name>DRAGON</ns1:name>
  <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:capability=dragon</ns1:urn>
  <ns1:id>1</ns1:id>
  <ns1:description>dynamic networks provisioning capability</ns1:description>
  <ns1:controllerURL>https://idc.dragon.maxgigapop.net:8443/axis2/services/OSCARS?wsdl</ns1:controllerURL>
</ns1:capability>
<ns1:capability>
  <ns1:name>PlanetLab</ns1:name>
  <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:capability=planetlab</ns1:urn>
  <ns1:id>2</ns1:id>
  <ns1:description>virtualized computational resources</ns1:description>
  <ns1:controllerURL>https://max-mypic.dragon.maxgigapop.net/PLCAPI/</ns1:controllerURL>
  
```

## Example using a generic SOAP client

location of top-level Recursive AM API

method functions exported by WSDL

capability filterspec  
"nodes with DRAGON capability"

response from ListNodes function

ListNodes responds with a list of DRAGON-capable nodes (3 nodes are shown here)

The screenshot shows a SOAP client window titled "Untitled". The WSDL field is set to `http://geni.dragon.maxgigapop.net:8080/axis2/services/AggregateGENI?wsdl`. The "Method" dropdown is open, showing a list of functions: ListCapabilities, ListNodes (selected), CreateSlice, DeleteSlice, UpdateSlice, StartSlice, StopSlice, ResetSlice, and QuerySlice. The "Parameter" field contains `capabilityURN: urn:ogf:geni:domain=dragon.maxgigapop.net:capability=dragon`. The "Raw Response" tab is active, displaying the following XML:

```

<ns1:ListNodesResponse xmlns:ns1="http://aggregate.geni.net/services/api">
  <ns1:node>
    <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:node=PLANETLAB5</ns1:urn>
    <ns1:id>5</ns1:id>
    <ns1:description>planet lab5.dragon.maxgigapop.net</ns1:description>
    <ns1:capability></ns1:capability>
    <ns1:capability></ns1:capability>
  </ns1:node>
  <ns1:node>
    <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:node=PLANETLAB4</ns1:urn>
    <ns1:id>6</ns1:id>
    <ns1:description>planet lab4.dragon.maxgigapop.net</ns1:description>
    <ns1:capability></ns1:capability>
    <ns1:capability></ns1:capability>
  </ns1:node>
  <ns1:node>
    <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:node=PLANETLAB3</ns1:urn>
    <ns1:id>7</ns1:id>
    <ns1:description>planet lab3.dragon.maxgigapop.net</ns1:description>
    <ns1:capability></ns1:capability>
    <ns1:capability></ns1:capability>
  </ns1:node>
  <ns1:name>DRAGON</ns1:name>
</ns1:ListNodesResponse>

```

## Example using a generic SOAP client

The screenshot shows a SOAP client window titled "Untitled". At the top, the WSDL field is set to "http://geni.dragon.maxgigapop.net:8080/axis2/services/AggregateGENI?wsdl". Below this, the "SOAP Request Settings" tab is active, showing the following configuration:

- Service: AggregateGENI
- Method: ListNodes
- EndpointURI: http://geni.dragon.maxgigapop.net:8080/axis2/services/AggregateGENI/
- Binding Style: document
- SOAPAction: ListNodes
- Namespace: http://aggregate.geni.net/services/api/
- Parameters: capabilityURN: urn:ogf:geni:domain=dragon.maxgigapop.net:capability=dragon

The "Execute" button is visible at the bottom right of the configuration area. Below the configuration, the "Raw Response" tab is selected, displaying the following XML response:

```
<ns1:node>
- <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:node=PLANETLAB5</ns1:urn>
- <ns1:id>5</ns1:id>
- <ns1:description>planetlab5.dragon.maxgigapop.net</ns1:description>
- <ns1:capability>
  <ns1:name>DRAGON</ns1:name>
  <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:capability=dragon</ns1:urn>
  <ns1:id>1</ns1:id>
  <ns1:description>dynamic networks provisioning capability</ns1:description>
  <ns1:controllerURL>https://idc.dragon.maxgigapop.net:8443/axis2/services/DSCARS?wsdl</ns1:controllerURL>
</ns1:capability>
- <ns1:capability>
  <ns1:name>PlanetLab</ns1:name>
  <ns1:urn>urn:ogf:geni:domain=dragon.maxgigapop.net:capability=planetlab</ns1:urn>
  <ns1:id>2</ns1:id>
  <ns1:description>virtualized computational resources</ns1:description>
  <ns1:controllerURL>https://max-myplc.dragon.maxgigapop.net/PLCAPI/</ns1:controllerURL>
</ns1:capability>
</ns1:node>
```

location of top-level Recursive AM API

capability filterspec  
"nodes with DRAGON capability"

response from ListNodes function

"zoom in" on node planetlab5: it supports two capabilities

DRAGON (can terminate VLAN)

but also:  
PlanetLab (can create VMs)

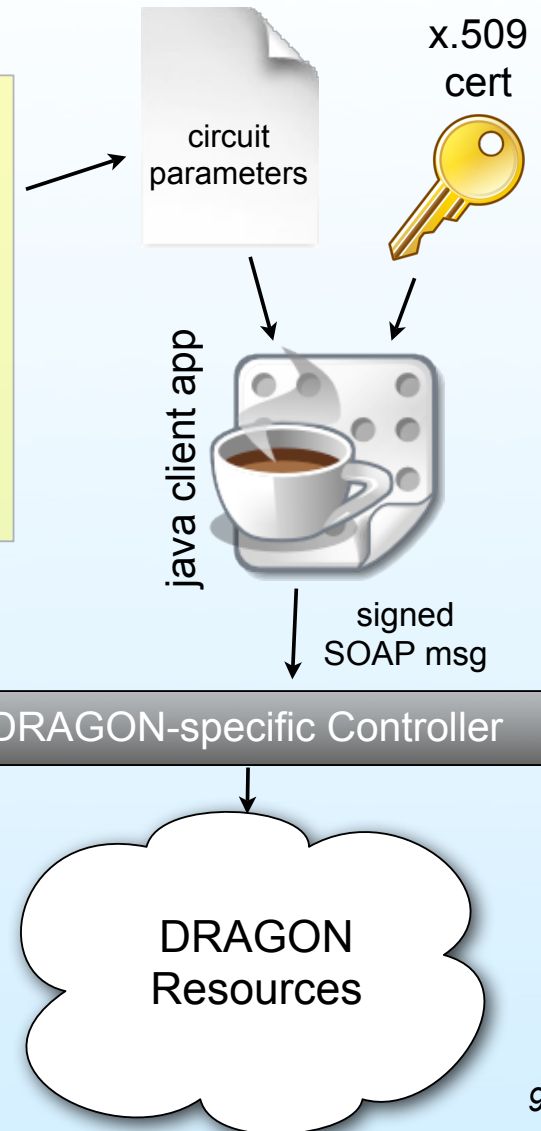
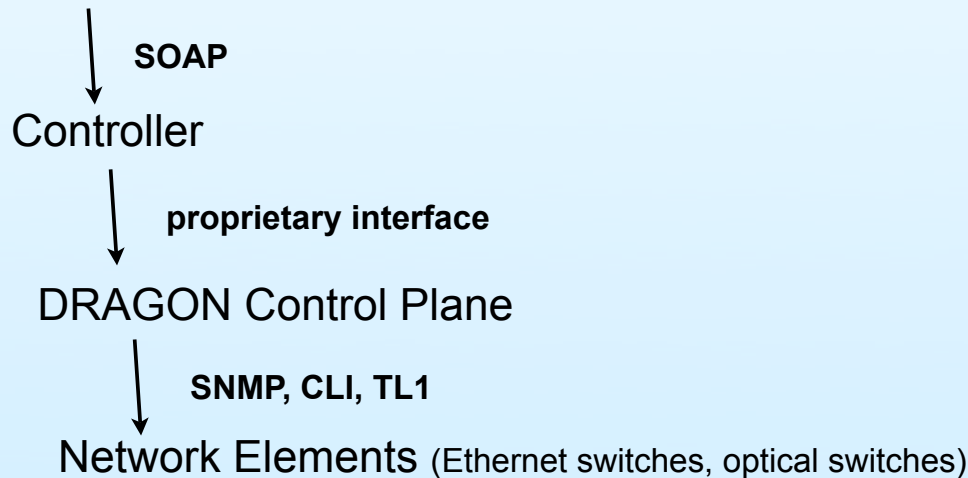


## SOAP-based Circuit Provisioning

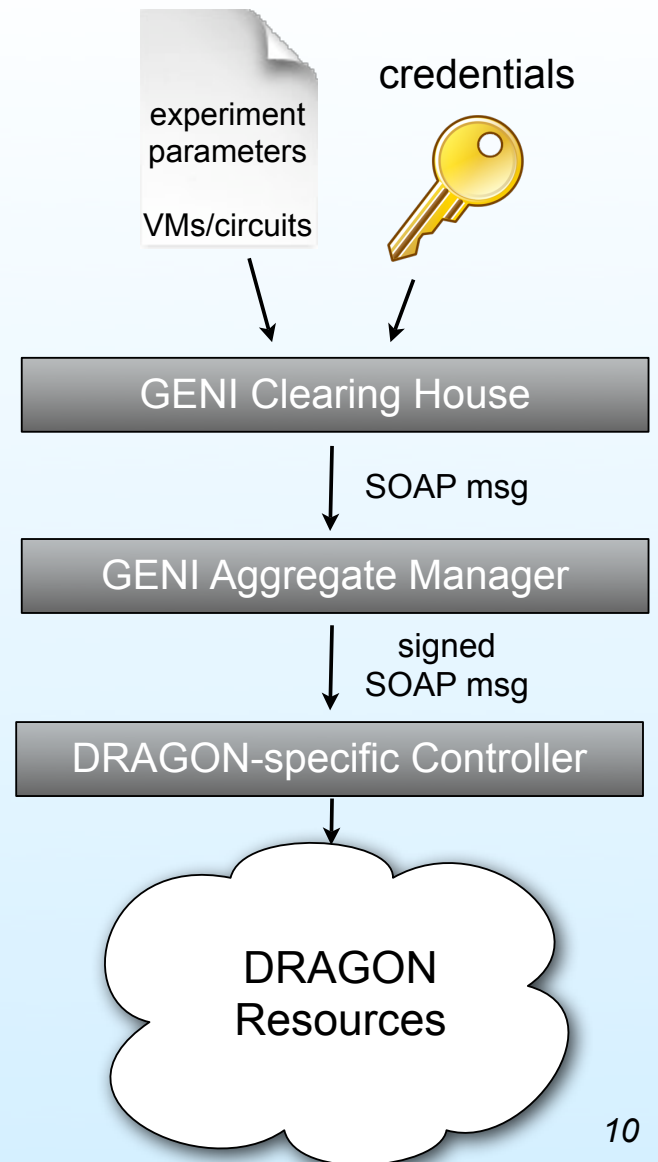
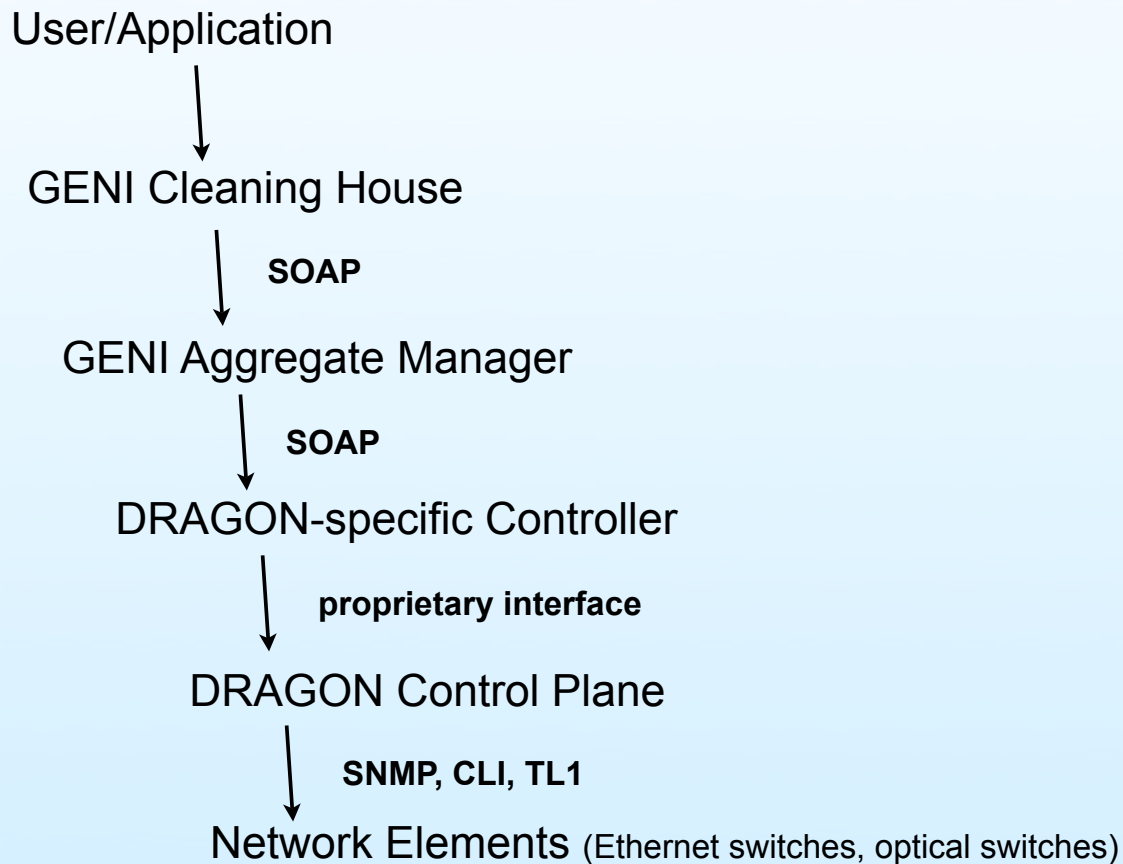
```

interactive=0
url1=https://idc.dragon.maxgigapop.net:8443/axis2/services/OSCARS/
layer=2
sourceEndpoint=planetlab5.dragon.maxgigapop.net
destEndpoint=phoebus.losa.dcn.internet2.edu
vtag=any
bandwidth=900
description="GEC5 demo: phoebus.losa--planetlab5"
pathSetupMode=timer-automatic
start_time=
end_time=
duration=4.0
    
```

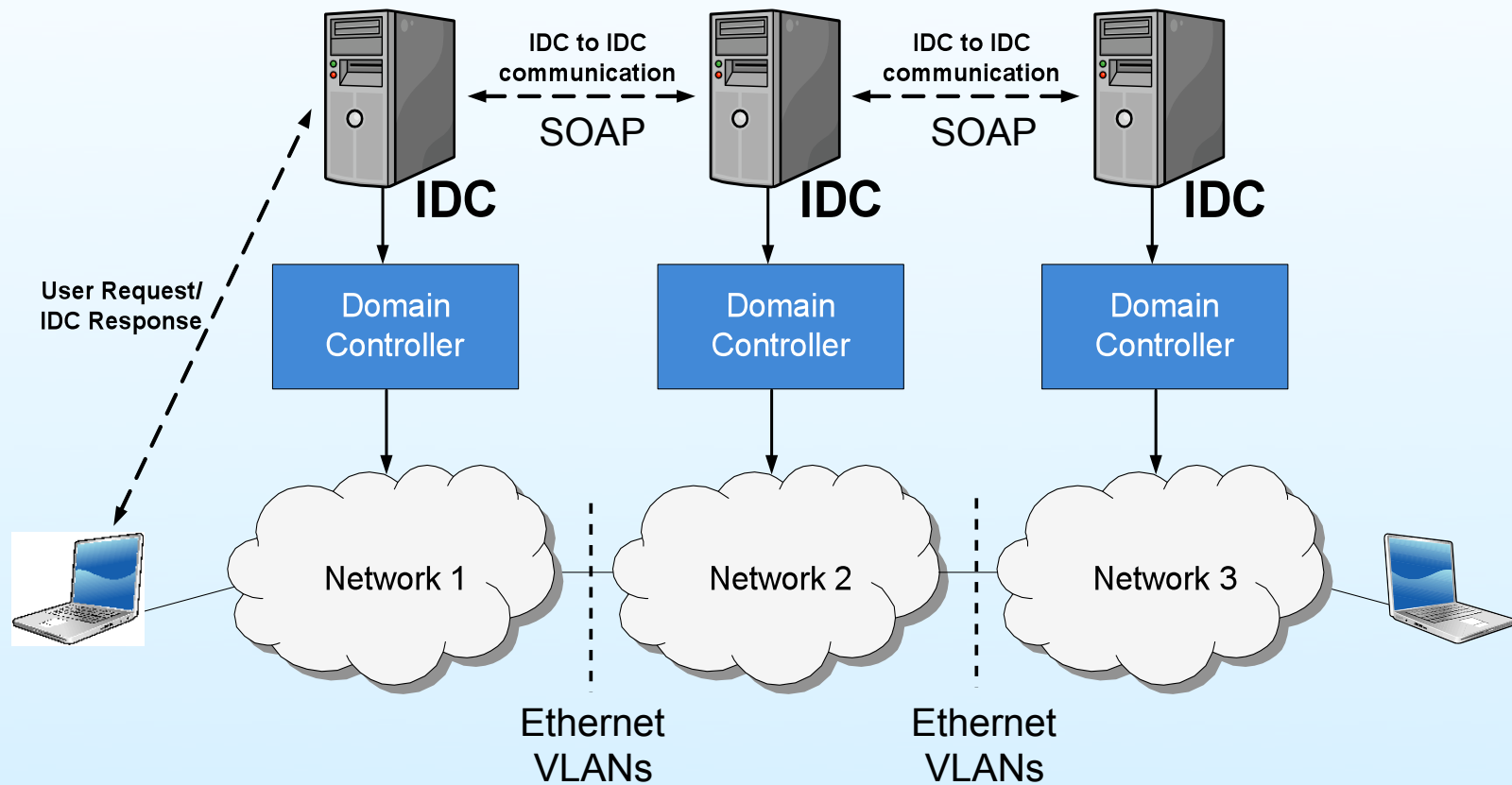
User/Application



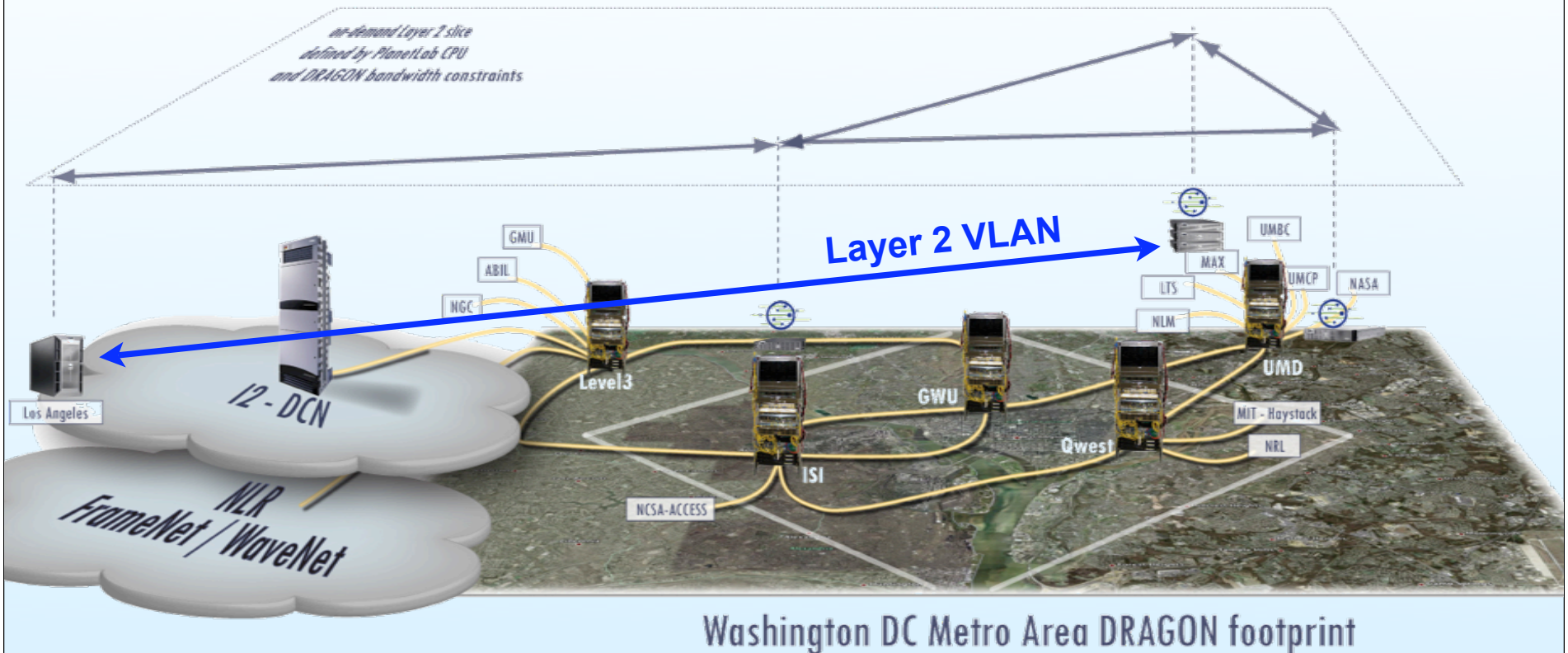
## *GENI Circuit Provisioning*



## Inter-Domain Circuit Provisioning



## *Inter-Domain Circuit Provisioning*

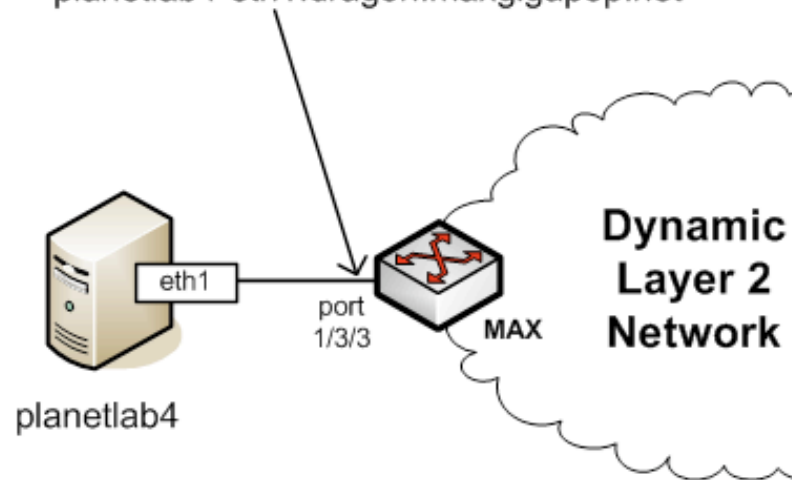


## *PlanetLab and Dynamic Circuits*

- Each of our PlanetLab nodes has a connection to the Dynamic Layer 2 Network:

This physical switch port has a globally unique ID (using URN scheme):  
urn:ogf:network:domain=dragon.maxgigapop.net:node=MAX:port=1-3-3:link=\*

URN may be found using a distributed hierarchal lookup service (DNS-like):  
planetlab4-eth1.dragon.maxgigapop.net

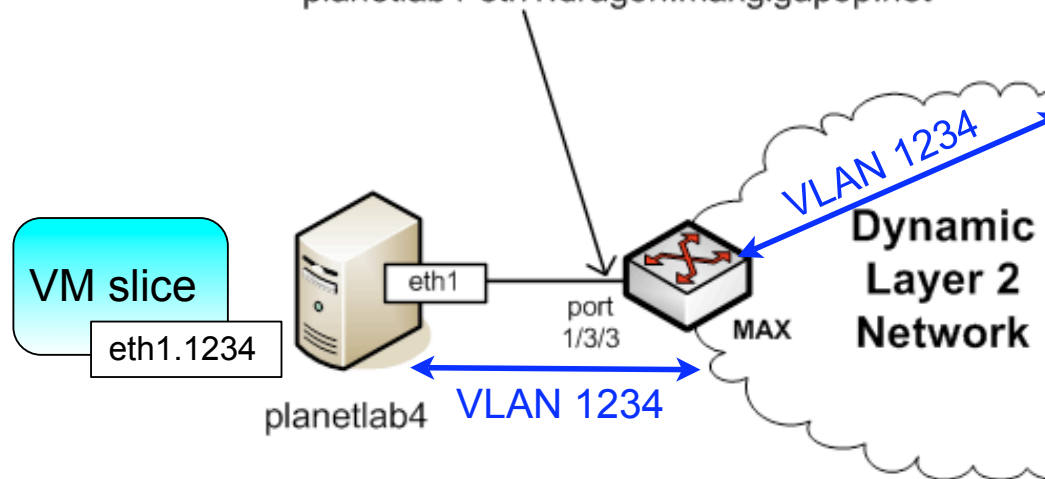


## *PlanetLab and Dynamic Circuits*

- PlanetLab did not have a general way to add a tagged VLAN interface to a user's slice, or to specify a link resource in the RSpec:

This physical switch port has a globally unique ID (using URN scheme):  
urn:ogf:network:domain=dragon.maxgigapop.net:node=MAX:port=1-3-3:link=\*

URN may be found using a distributed hierarchal lookup service (DNS-like):  
planetlab4-eth1.dragon.maxgigapop.net

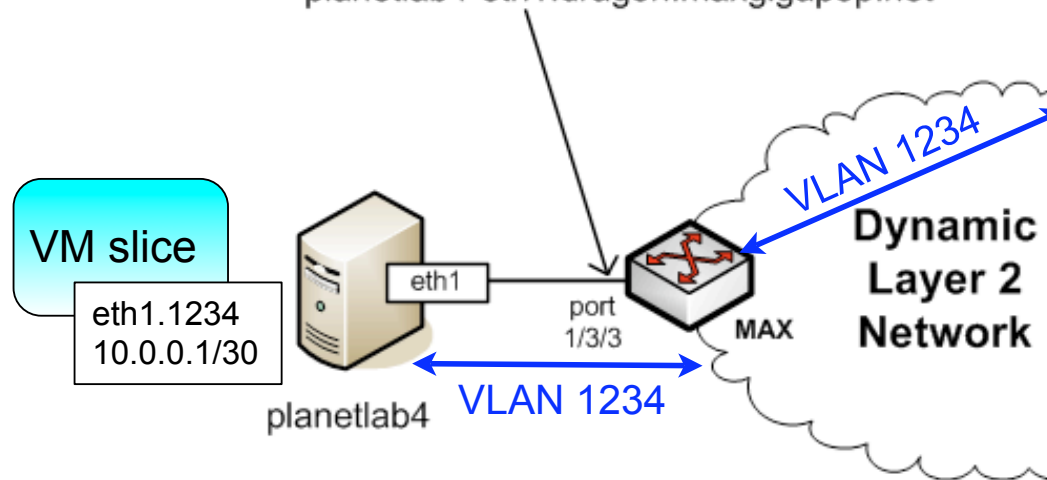


## *PlanetLab and Dynamic Circuits*

- PlanetLab has been extended with new slice attributes that specify allowed VLANs and IP addresses on a per-slice basis (using vsys):

This physical switch port has a globally unique ID (using URN scheme):  
urn:ogf:network:domain=dragon.maxgigapop.net:node=MAX:port=1-3-3:link=\*

URN may be found using a distributed hierarchal lookup service (DNS-like):  
planetlab4-eth1.dragon.maxgigapop.net



*Thanks!*

- Questions or comments are welcome
- These slides will be posted at:
  - <http://geni.maxgigapop.net>
  - click on Publications
  - scroll to GEC5